1/10th of an inch in diameter, and are spherical or oblong in form, the translucent membrane appearing under the microscope to be composed of minute particles and spicules imbedded therein.

As my observations included the examination of surface-life, the tow-net was continuously employed, and was always rapidly filled with so much gelatinous substance that it was difficult to pick out the Copepoda or other pelagic life. But although all of the bodies were perfect in form when taken in a bottle, the rush of water into the tow-net was sufficient to fracture them, the result being a mass of broken gelatinous *débris* (apparently vegetable) which clung tenaciously to the muslin of the net.

They appeared to be most numerous a few feet below the surface, and are distinctly visible on looking down into the water from the boat-side. Weather does not seem to affect them, being apparently equally prevalent on a calm or a rough day; but I noticed while rowing across from Penmaenmaur to Puffin Island, a distance of seven miles, that they were less plentiful about the middle of the entrance to the Menai Straits than nearer each side.

Early in June they were in profusion about the mouth of the Dee. Associated with them I have invariably found quantities of *Noctiluca*, which soon congregated about the surface of the collecting-jar, while the gelatinous spheres remained suspended in the water, and the *débris* from the tow-net fell to the bottom.

Any light that can be thrown upon the nature and appearance of these curious bodies will be much esteemed.

Liverpool, July 16 ISAAC C. THOMPSON

The Banner System of Drainage

OUR attention has been called to a paragraph in NATURE (p. 221) in which you review, "Hygiene, a Manual of Personal and Public Health," by A. Newsholme, M.D., Lond. In your review or criticism you state that you "do not agree with Dr. Newsholme in thinking the 'Banner system of drainage one to be recommended,'" and you say your system coincides with that of *several practical sanitarians*. Now, as this is calculated to do harm, and as our system *has* been *approved* of by the *most* eminent sanitarians, and has also obtained the highest awards at all the most important exhibitions, including a Gold Medal at the Health Exhibition, 1884, and has been successfully applied to many noblemen's mansions, hospitals, and other important public buildings, as well as to thousands of houses, we hope you will think we are justified in asking you to tell us your reasons for expressing the unfavourable opinion you have, and that you will oblige us with the names of the "practical sanitarians" you refer to.

We are unacquainted with Dr. Newsholme, and until the paragraph in NATURE was pointed out to us we were not aware of the existence of such a gentleman. Nevertheless, in fairness to him as well as to the public, we will thank you to insert this in your next issue.

BANNER BROTHERS AND CO.,
per MANAGER

11, Billiter Square, E.C., July 14

[Exception having been taken by Messrs. Banner & Co. to a statement which appeared in our last issue in the review of the Elementary Text-books of hygiene, having reference to this system, we have no objection to state that (in the opinion of our reviewer) the Banner system, although correct in principle, is unnecessarily complicated in the details of its working. The "Banner Patent Closet" shown in diagram in the book referred to is a modification of the pan-closet, a closet which has been universally condemned and as almost universally acknowledged to be incapable of improvement.—ED.]

ON THE USE OF CARBON BISULPHIDE IN PRISMS[1]

IN the *American Journal of Science* for April, 1885, there is an account of some experiments of Dr. Draper's which will be read with great interest by all who have used liquid prisms in a spectroscope. The following is an abstract of the article:—

The photographs which were taken in the research on the presence of oxygen in the sun were obtained by the use of two hollow prisms filled with carbon bisulphide. The same prisms had been used by Mr. Rutherford to produce his celebrated solar prismatic spectrum. The photographic work for the oxygen research was done in New York in a back room of the third storey of Dr. Draper's residence. The temperature of the room was remarkably uniform and the definition was all that could be desired. When, however, the research was continued in the new physical laboratory which Dr. Draper completed in 1880, it was found practically impossible to use carbon bisulphide prisms in the room owing to the rapid variations of temperature. No definition whatever could be obtained with the same prisms which had performed so well previously. In consequence the use of these prisms had to be abandoned and a series of experiments made to obtain the spectrum by other means. A Rutherford silvered glass grating of 8640 lines to the inch and a train of six flint glass prisms made by Steinheil were each tried. The grating was not found satisfactory, partly because want of light rendered long exposure necessary, partly because the definition was not so good as had been originally obtained from the bisulphide prisms. The flint prisms gave excellent definition, quite as good as had been obtained with the bisulphide prisms, but there was less light, and it was found impossible to get the line H on the photographic plate, through the train. The dispersion between G and H with the six flint prisms was not quite so great as with the two bisulphide of carbon prisms.

Among the earliest experiments which were undertaken in the new laboratory was a series made to test the performance of a bisulphide prism of Thollon's construction, made by Hilger, of London. This prisms consists of a glass bottle having two plane sides, making an angle of 90° with one another, upon which are cemented two prisms of flint glass 4 by 2 inches on the face, having each a refracting angle of 18°. The refracting edges of these glass prisms are opposed to that of the bisulphide prism. Hence the refracting angle of the compound prism is 54°. The same difficulties were experienced with this prism as with the Rutherford bisulphide prism. Owing to the temperature variations the lines were "woolly" and no definition was possible. It was found that the dispersion power of the Thollon prism was equal to that of about four of the Steinheil flint prisms; and this fact, together with the unsatisfactory character of the results obtained with the train of prisms as well as with the grating, led Dr. Draper to undertake an investigation into the cause of this unsteadiness of the bisulphide with a view to remedying it if practicable.

While using these prisms Mr. Rutherford made an important observation. He noticed that if a good prism which, with a high power, refuses to define the soda line (a more stringent test than soda lines), is violently shaken and then placed in position, it will for a few minutes define beautifully, but gradually settle to its former condition.

It occurred to Dr. Draper, therefore, that possibly the striæ caused by convection-currents produced by inequalities of temperature, and which caused the bad definition, might be destroyed by an active agitation of the liquid. He therefore placed a small propeller wheel in the bisulphide contained in the Thollon prism, passing its shaft through the stopper so that he could drive it at any desired speed by an electro-motor. The result was marvellous: by thus keeping the liquid in agitation all inequalities in its density were prevented, and the definition became excellent. Thus arranged, the Thollon prism was found to be superior, especially in quantity of light, to the Steinheil train of prisms.

Now another source of error was developed. Although when the propeller was running the definition of the bisulphide was not affected by changes of temperature, yet now these changes of temperature, by changing the refractive index of the liquid, caused a continual shifting of

[1] Being an account of experiments made by the late Dr. Henry Draper, of New York.

the position of the lines in the spectrum. It is obvious, therefore, that during an exposure of any considerable duration, such as is often necessary with faint spectra, this change of position of the lines due to temperature-change would absolutely destroy the definition n othe photographic plate. The shifting of the lines on the plate were found to amount to 0·1 inch for 1° F. An even-temperature box of metal containing cotton was made, and the prism arranged within it. The temperature was regulated by a thermostat contained within the box, consisting of a compound bar of brass and ebonite, which turned on or off the gas as necessary. Afterwards one even-temperature box was placed within another, and it was then found that the temperature could be kept uniform for a long time within 0°·1 F., and then the lines did not shift at all so much as the distance between the sodium lines. With this arrangement many hours were taken by the box to settle down to a new temperature, so that, if a change of over 10° F. is to be made in the temperature of the box, it is doubtful whether the spectrum would become stationary in less than twenty-four hours.

The results have a two-fold bearing. In the first place they prove that, by the simple expedient of stirring the liquid in the prism, all striæ may be prevented and the definition rendered perfect. The practical value of this simple expedient is very considerable. The Thollon bisulphide prism, while giving seven-eighths as much dispersion as six flint prisms, gives four times the light in the entire spectrum and eight times the light in the region near G. For photographic purposes, now that the definition can be made permanently sharp and the shifting of the lines prevented, this prism must replace trains of glass prisms, and even gratings, unless these are of large size and are used with telescopes of proportional aperture.

In the second place, this investigation has called attention in a very marked manner to the change in refracting power with change of temperature. This subject has already been discussed by several authors, who agree with the statement of Arago and Neumann, that for glass the law is the reverse of that given for liquids, and that the refractive index increases with the temperature. In the case of the Thollon prism the refractive index increases as the temperature diminishes. As Mendenhall has shown that no change takes place in the angle of the prism with change of temperature, it follows that the observed change of refractive power of the Thollon prism is a differential result due to the excess of the index of the bisulphide in one direction over that of the glass in the other.

It will ever be a source of regret that Dr. Draper did not live to complete the research to which the foregoing investigation was preliminary. With his new and admirably equipped laboratory and with this powerful and thoroughly corrected photographic spectroscope at his command, no one can doubt that he would have secured with it results of the highest value to astronomical, and especially to solar, physics.

PREVENTING COLLISIONS WITH ICEBERGS IN A FOG[1]

THE recent accident to the steamer *City of Berlin* emphasises the importance of devising practical methods of ascertaining the proximity of icebergs in a fog. The precautions adopted by Capt. Laud, though they saved the lives of more than 1400 passengers, and prevented serious damage to the vessel, did not prevent contact with the berg. Even the "look-outs" were unaware of the proximity of the iceberg until it was actually upon them.

Under these circumstances the method proposed by Mr. Frank Della Torre, of Baltimore, deserves consideration. His experiments indicate the possibility of obtaining an echo from an iceberg when in dangerous proximity to a ship. Mr. Della Torre believes that even an object offering so small a surface as a floating wreck may in this way be detected during a fog in time to prevent collision. However this may be, it is certain that his method is worthy of a careful trial at sea, and that preliminary experiments, recently made in the presence of Prof. Rowland, of Johns Hopkins University, and the present writer, have demonstrated the feasibility of producing well-marked echoes from sailing-vessels and steamboats at considerable distances away.

These experiments were made on the River Patapsco, near the head of Chesapeake Bay, at a point about seven miles from the City of Baltimore. The party proceeded down the river in a steam-launch to the selected place, where the distance from shore to shore appeared to be about three miles.

The launch was kept so far from land as to prevent the possibility of mistaking an echo from the shore for one produced by a passing vessel.

The apparatus employed consisted of a musket, to the muzzle of which a speaking-trumpet had been attached. This gun was aimed at passing vessels, while blank cartridges were fired. After a longer or shorter time, according to the distance of the vessel, an echo was returned.

The ordinary river-steamboats, and schooners with large sails, returned perfectly distinct echoes, even when apparently about a mile distant. At shorter distances the effects were, of course, still more striking.

In order to test the effects under the most disadvantageous circumstances, blank cartridges were fired in the direction of an approaching tug-boat. The surface presented was, of course, much smaller than if the boat had presented its broadside to the launch. As the boat approached bow on it corresponded to a target somewhere about six feet square, presenting a convex surface to the impinging sound-wave. Even in this case a feeble echo was perceived when the boat was at a considerable distance (estimated to be nearly one-quarter of a mile). That any echo should have been perceived at all under such circumstances was a surprise. The sound was heard only by the closest attention, but in the case of larger vessels the effects were very distinct and striking.

Experiments were made which demonstrated the fact that the speaking-trumpet attached to the gun was of material assistance in giving direction to the sound-impulse, and in intensifying the audible effect.

Mr. Della Torre claims that a steam-whistle or siren, combined with a projecting apparatus like a speaking-trumpet, will prove as efficient as the gun.

During the experiments on the Patapsco River a curious rumbling effect like the rolling of thunder was often observed, which continued for some seconds. A similar sound was also noticed, as an echo from a well-wooded shore; but the effect alluded to above could not have been due in any way to the land, as the sound commenced immediately upon the firing of the gun, whereas the shore was distant at least a mile or a mile and a half.

The sound was probably due to the presence of ripples on the surface of the water, as the effect was much less marked when the surface was smooth. Such a sound might prove a disturbing element of importance in a rough sea, but would hardly be sufficient to prevent the detection of an echo from a large iceberg. Had shots been fired periodically from the bow of the *City of Berlin* it can hardly be doubted that the presence of an obstacle ahead would have been discovered in time to prevent the collision that actually occurred.

ALEXANDER GRAHAM BELL

[1] From *Science*